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Lejja archaeological site, Southeastern Nigeria and its potential for archaeological science research

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Abstract

In 2017/2018, two seasons of archaeological surveys were undertaken in Lejja, southeastern Nigeria. The aim of the archaeological field work was to systematically sample the area to locate archaeological sites, scatters of artefacts, features; and to characterize and record these findings. A particular objective was to identify sites with different typological or chronological characteristics and to then select representative examples for further investigation and excavations. This paper thus focuses for the first time; on the general knowledge of the archaeological signatures in addition to iron working that abound at the Lejja site from an archaeological perspective. We aimed to identify sites with evidence of iron production and sites with other characteristics of human habitation to compare inter-site variation. Using ethnoarchaeological studies, archaeological surveys and excavations, sixteen new sites were identified stretching from iron smelting sites to domestic/habitation sites and ancestral sites. We utilized both a systematic transect and an opportunistic approach to locate and map the archaeological sites encountered. The focus of the study was on thirteen key villages in Lejja southeastern Nigeria. Analysis of data shows that there seem to be distinct areas on the landscape for habitation and metal working respectively. However, it is unclear as yet what this distinction represents in terms of social organization, particularly whether they represent one community with different activity sites or two communities with distinct identities or indeed a more complex temporal and spatial patterning.

Keywords Lejja, Archaeological science, Archaeological sites, Iron working, Southeastern Nigeria, Igboland, Technological processes

Introduction

This paper revisits and repositions the debate on iron metallurgy in southeastern Nigeria and offers a new insight on the effectiveness of the technological process and social dimension through time in Lejja. Lejja is a cluster of settlements that consists of 33 villages in

Nsukka, southeastern Nigeria where iron smelting was carried out on a large-scale (see Fig. 1). Previous archaeological surveys in Lejja have been highly limited and largely remain unpublished. However, no systematic survey has been associated with iron working to locate and explore associated settlement sites and consequently we know very little about these early metal producing communities and the economy across this metal working period beyond the technologies they employed. It seems likely that the previous researchers have conducted ad hoc surveys. One notable survey was conducted in April and May 2007 where excavation and survey were carried out at Dunuoka village (which is one of the 33 villages in Lejja) by colleagues from the Department of

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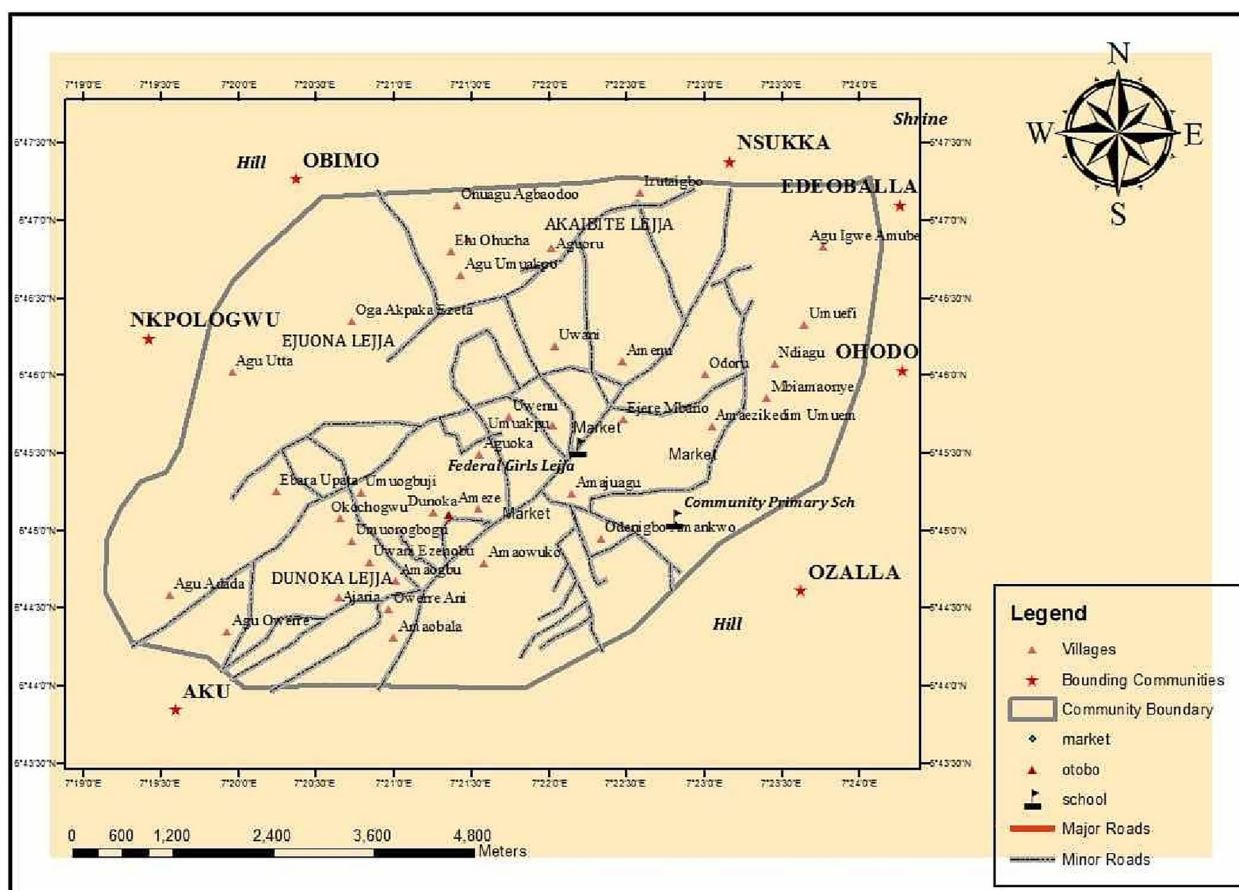


Fig. 1 Map of Lejja showing the thirty-three villages

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Prior to the excavation at Dunuoka, a reconnaissance survey was carried out specifically around this village to document as much information on the surface evidence as possible prior to making decisions on where to excavate [1]. The aim of the 2007 study was to obtain a general understanding of the range of sites and finds in this area (see Fig. 2). Notably, during the survey, most of the materials that were exposed on the surface and from the road cuttings indicated evidence of iron smelting such as furnace remains, iron ores, cylindrical slag blocks and broken pieces of slag. Some potsherds and little slag were collected. As noted in [1], no detailed information has yet been published except that the survey revealed multiple iron smelting sites in and around the excavated area.

The survey limits for this study were defined based on the 33 villages and the local understanding of the settlements and land that constitutes Lejja. The land around these transects was surveyed with several transects A-I. The topography sampled in each case comprised of hills

and valley bottoms. The survey team consisted of 5 individuals walking in a line at an interval of 10 m with the person at the centre controlling the direction with the aid of a compass. In addition, one extra person measured the distance covered with a GPS. Once an artefact or a feature was discovered the team stopped and radiated outwards to identify associated finds or features. Note was made of the location, size/diameter of surface materials, an estimate of artefact density, surface features and type of landform on which it was located. For each site, the presence of surface features such as pottery, slag and other artefacts was especially noted, and samples were randomly retrieved. The sites located can be grouped into three categories: smelting sites, domestic sites, and ancestral sites.

Method of data collection

The data were collected via transects and opportunistic surveys. Transect surveys involve field walking, or surface collection which entails systematic collection of artefacts from areas that might be indicative of human settlement. Field walkers proceed along a measured section of

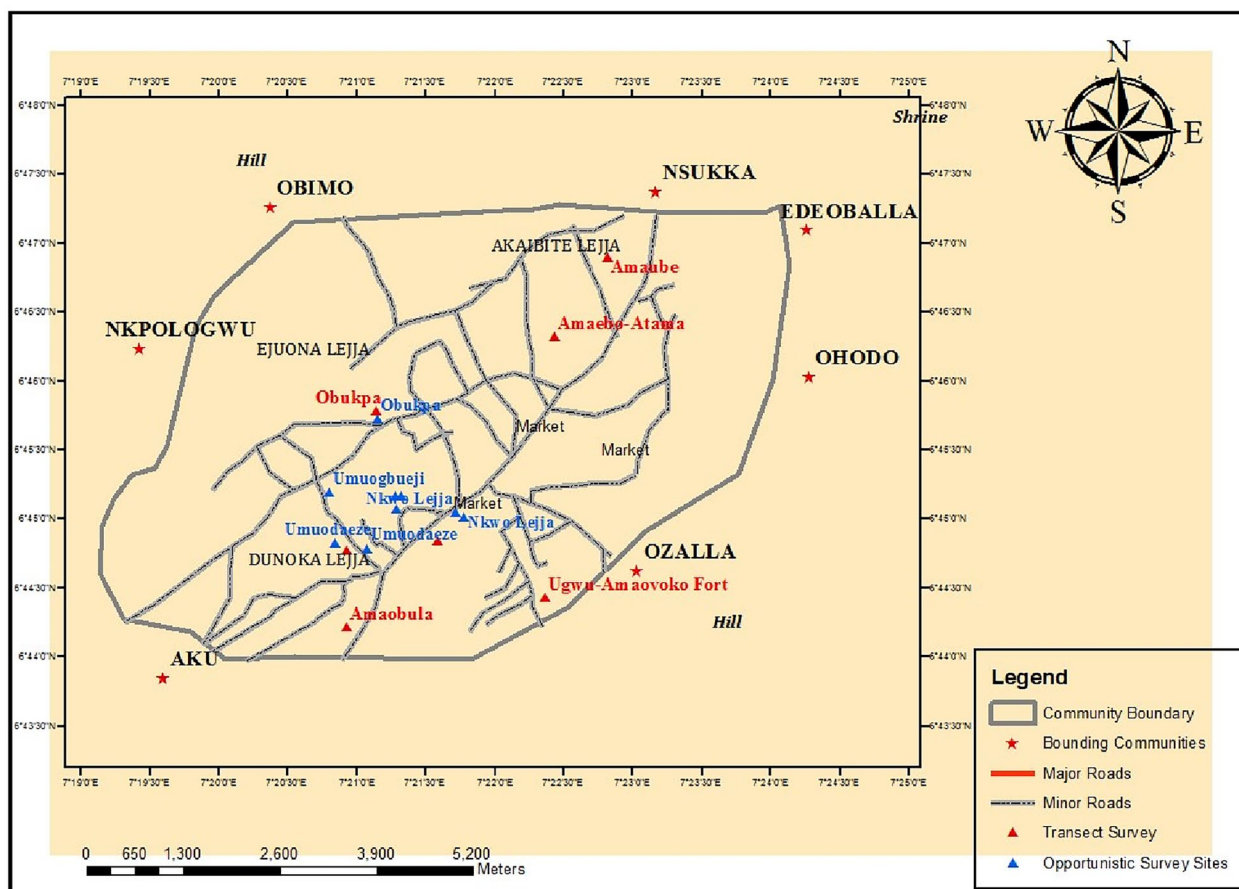


Fig. 2 Spatial /distributions of some iron smelting and domestic sites mentioned in the text

a traverse or around a grid collecting materials they see lying on the surface before them. Once the area(s) to be surveyed has been selected, it will be surveyed by the team across the area. For opportunistic surveys, we had to rely on the information given to us by local inhabitants to locate the sites.

Survey results-transect

Transect A began at the village of Amaovoko and extended in the south western direction for approximately 70 m. This starting point was chosen for several reasons. First, an initial visit to the village and discussions with the elders revealed evidence of iron working remains, shrines, ancestral trees, and clusters of potsherds. In this village, the survey was easy because the vegetation is sparse, and we were able to manoeuvre easily. Transect A was located at four sites, which were recorded as A01-A04. A1 is the concentration of cylindrical slag remains which was exposed by erosion (see Figs. 3 and 4). The scattered cylindrical slag blocks extend along the edge of an erosion scar at the end of a road cut with a maximum diameter of at least 8 m and a maximum



Fig. 3 Concentration of cylindrical slag

artefact density of c. 50 fragments of pottery, tuyère and slag per m². Cylindrical slag are evidence of early Nsukka iron smelting phase (see Fig. 5). During this phase, slag is tapped intermittently from the furnace through a connecting pipe (tuyère) to a hole lined with clay. The slag solidified in the pit forming cylindrical blocks weighing



Fig. 4 Concentration of broken Blocks at Transect A pieces of furnace wall and slag at Transect A



Fig. 5 Cylindrical Slag block



Fig. 6 Extensive Field Boundaries and Terracing

43 to 47 kg with an average density of 3.89 gm/cm^3 [2]. These cylindrical slag blocks are very large with a diameter of 31 and 56 cm, and are often found in village squares as well as on landscapes [2] (Fig. 6).

Site A02 is a cluster of potsherds located 20 m from site A01. Most of the potsherds are decorated with a roulette design and with a maize cob pattern, although one

potsherd was decorated with a knotted fibre design that looked as if it was impressed on the potsherd. This scatter was approximately 4 m in diameter with an artefact density of 10 potsherds per m^2 . The presence of maize cob decoration on the pottery from A02 suggests that the site chronology could range between the late 15th and 16th Century AD since maize was imported into West Africa during that period. Additionally, it has been opined that roulette traditions in Lejja date between to 14th–15th Century AD on the basis of pottery found from the excavations conducted in Amaovoko in 2010. Moving further down on the same transect, site A03 consists of a dense concentration of aggregate slag, some furnace remains and some pieces of tuyère fragments. The slag fragments and furnace remain number approximately 10 and 15 per m^2 respectively, with the scatter having a diameter of approximately 4 m. Site A04 consists of the remains of a small circular furnace wall with the outline clearly visible on the surface. This furnace wall measured 1.6 m in diameter with a wall thickness of approximately 0.3 m and a circumference of 5 m. Overall, transect A possesses many features of a densely occupied iron smelting landscape.

Transect B was carried out in the village of Amaebo-Attamah, which was selected as a start for the survey because local informants identified it as the second oldest habitation site in Lejja. The transect extends in the NE direction from Amaebo-Attamah and three sites B01, B02 and B03, were recorded. Although not an extensive site, B01 was recorded because it consisted of an impressive lone globular pot with an everted rim, a diameter of 24 cm and a rim thickness of 3.5 cm. The roulette impressed designs could be seen all over the body of the pot. This type of pot is called an *itemmili* (water pot) and is used for collecting water from the streams or lakes and sometimes for storing water. This kind of pot is used in contemporary contexts but may have a deeper history. The dense vegetation at site B01 made it impossible to see any other features but it seems likely that the pot indicated a habitation site that may be worthy of future exploration. Site B02 consisted of scattered potsherds with a maximum density of approximately 10 fragments of pottery per m^2 . These potsherds had the same decorative motifs as did the large pot at site B01.

Site B03 consists of one old mortar for palm oil production. Pounding mortars are known in the local dialect as *ikwe*, and these mortars made from wood were hollowed using fire directed to them by fans. Mortars are commonly used for pounding oil palm and extracting its content. Most horizontal oil palm mortars measure approximately 0.3 m in diameter and are currently known to be used presently in southeastern Nigeria. Vegetation here prevents the identification of wider

site features, but it seems likely that wider features and surface finds would be found on more thorough investigations.

Transect C started and finished in the village of Umuo-daeze, and two domestic sites (C01-C02), were recorded. These two sites displayed a good number of potsherds on their surfaces. At C01, the surface scatter measures c. 7 m in diameter, with a cluster of fibre knotted roulette and criss-cross decorated potsherds. The fibre knotted potsherds are different from other types of roulette decorated potsherds in terms of the technique of decorations which are commonly observed on the surface in some of the surveyed areas. A short distance away from C01 is the Oshuru-Otobo shrine (C02) which is referred to as a war shrine by the present inhabitants. In Igbo culture, shrines are recognised and revered places of worship by people. A historical narrative from the oldest man in the village purported that prior to embarking on any war with neighbouring communities; a war ritual was carried out in this shrine. This ritual entails the warriors dancing and running around the tree in the shrine. If anyone falls, he will be eliminated, as it implies that he has a bad spirit and is not eligible to go to war. Of interest at this shrine are small scatters of broken undecorated burnished pots.

Transect D was located across the Ugwu-Amaovoko hilltop to sample a higher elevation area. The transect was located only one at site D01, which is on top of the hill and covers approximately 50 m in diameter with a range of features and finds. Several hillside terraces were recorded but did not show any signs of use and seemed abandoned for a long time. Oral tradition states that the first people who arrived at Lejja settled on the hilltop, planted, and cultivated crops (terrace farming) very close to their settlement to be able to tend/grow their crops. Due to erosion, they built an embankment and created plots to check for erosion and the flow of water [3]. Their gradual efforts at preventing flood erosion made them line the bases and sides of their hill slope plots with pieces of broken quartzite unearthed from their farms during the tillage of the soil and the actual cultivation of the hill slopes. With more years of such continued practices, the lined stones developed into very high terraced hill slopes, attaining heights of approximately 3 m at the base and 1 m at the sides [3].

Survey transect E, was conducted to locate a fort on the hilltops that we were informed about. Beginning at the foot of the hill, we conducted a transect to the top of the hill on which the fort was located and identified five sites (E01-E05). E01 and E02 were domestic sites that each one produced potsherds. E01 had dense clusters of potsherds that may have come from a large vessel (see Fig. 7). The maximum density of the potsherds was approximately 80 potsherds per m².



Fig. 7 Scatter of roulette potsherds



Fig. 8 Horizontal groove potsherd approximately 7.5 cm in length

Roulette is the basic decorative motif on most of the potsherds at E01. Although well fired, the potsherds at E01 were gritty and coarse and had wall thickness ranging from 0.7 to 1.2 cm. E02 is located 30 m from E01 and produces a small scatter of c. 5 potsherds with lines of horizontal groove motifs on the neck (Fig. 8). These potsherds differed from the potsherds at E01. The remaining abandoned homesteads E03 and E04 are close to E02. E03 comprises of a rectangular mud brick structure 9 × 3 m in dimension. E04 is relatively small, at 5 × 3 m. Both houses could have been a nucleated homestead. Although considerably eroded, the walls of the houses stand up to two metres in height with evidence of the wooden frame still visible on both houses (see Figs. 9).

Approximately 100 m to the east is a stone wall (E05) that measures 12 m in width and comprises of circular and rectangular stone structures. Some parts of the walls have crumbled but some are still standing and are between 1.0 and 1.5 m in height. We are not sure what the wall could have been used for. However, contemporary evidence from the inhabitants living in the valley



Fig. 9 Abandoned Homesteads on the Ugwu-Amaovoko Hilltop

shows that it could have been used as a boundary marker. A large field close to these features was field walked but with no finds and 170 m to the south, a fort was recorded (E06). The structure of the fort is semi-rectangular and measures approximately 102 m in diameter. Several large scatters of roulette potsherds were recorded inside the fort, especially at the entrance of the fort NE of the site. These scatters contained pottery with a maximum density of 30 sherds per m². There is also evidence of an earthwork that runs across the fort. The earthwork consists of entrenchment or fortification that can be identified by a bank.

Without excavation and a more detailed survey, it is difficult to confirm the exact contemporaneity or antiquity of these features within the fort. However, the available evidence indicates the presence of a large community based on these material cultures that remain on the landscape. Oral accounts from one of the authors revealed that the earliest inhabitants of Lejja settled first at the hilltops and then subsequently moved down the valley, and then returned to the hilltops and permanently down the valley. In the olden days, they preferred hilltops

because of the striking views of the landscape and for safety. The fort may serve as a surveillance point for Lejja's warriors to monitor their surroundings, raise alarms and launch attacks against their enemies. From the hilltops, an attacking force could be seen from a long way. Although oral accounts are not always correct, it seems difficult to deny that the fort indicates the presence of a large community. This fort would be a very important site to sample in more detail through excavations and as such will be a target for future archaeological work in Lejja.

Transect F is composed of two long sections from the village primary school to the Umuezeoda ancestral hall. This village was chosen for the survey because oral tradition maintains that it has evidence of the remains of the first man who settled in Lejja. Only two sites were recorded (F01 and F02), and both were relatively isolated. The first is an isolated grave site (F01) and the second is a domestic site with scatters of pottery (F02). F01 is thought to represent the grave of the progenitor of Lejja and the first man to have settled in Lejja (Fig. 10), while F02 consists of only six pieces of decorated potsherd with a deep grooved motif. This grave is approximately 5 m in



Fig 10 Corresponding and third authors at the grave of Ezenlyni the progenitor

diameter and demarcated with stones placed in a semi-circular form. No other artefacts were found on this transect except for an *Ogirisi* plant (*Newbouldia laevis*) which was planted in the middle of the grave. The *Ogirisi* plant (*Newbouldia laevis*) is also used as a boundary marker in Igboland.

Survey G transects was 150 m long and ran north-south from the entrance of the village of Obukpa. Only two sites were recorded (G01-G02) on these transects. G01 and G02 were isolated concentrations of aggregate slag mounds about 4.5 m in diameter and 50 cm in height (Fig. 11). Aggregate slag is a by-product of a late phase of Nsukka iron smelting. Aggregate slag consists of fragments of rivulets of tapped slag with ropy and smooth surfaces, which are usually black or dark brown in colour [2]. They are highly vesicular and have a relatively low density. Tap slag is usually produced in iron smelting operations in which the furnace is provided with an aperture called a tuyere. Tuyeres are used for blowing air into the furnace and occasionally for draining the molten slag out of the furnace while smelting is in progress. The molten slag then solidifies outside the furnace or on the ground around the furnace [2]. The individual aggregate slag lumps weighed between 1.0 and 1.8 kg in mass. Most of the slag samples from this phase are magnetic [2]. Few fragments of iron ore were also present at transects G01 and G02 (Fig. 12).

Survey transect H (H01-H03) located several pottery sites; H01, H02 and H03. At H01, scatters of roulette pottery tradition and large amount of charcoal were identified. At H02, erosion has exposed in situ embedded potsherds beneath the surface which are mostly rim sherds. It seems likely that more potsherds might be uncovered if a shovel test pit was applied to examine the subsurface. The decorative motifs on the potsherds are deep grooved designs that have similar characteristics to those of the potsherds from Transect F. Close to H02



Fig. 12 Warrant chief house

is H03 which yielded a piece of manila and some cowry shell items that in the past were both used as a medium of currency, exchange, and trade in Lejja and elsewhere in West Africa. H03 is also situated on a well-known trade route that connects Lejja to other neighbouring towns including Opi, Aku, Ohodo, and other towns that are farther off, such as Abakiliki, Arochukwu, and Calabar.

Survey transect I located two iron smelting sites, I01 and I02, which are very close to each other. I01 consists of 2 cylindrical slag blocks and some tuyere fragments. At I02, erosion exposed in situ embedded furnace walls and clusters of aggregate slag. Transect I is very short, as shown by the proximity of both sites to each other at a distance of 15 m.

It is important to note that some of the transects recorded above further show evidence of more recent habitation, some of which likely fell in the late twentieth century. However, at Lejja according to the surface findings, there are variations in the pottery types with most of the surface collections of potsherds belonging to the roulette tradition, specifically the fibre knotted roulette,



Fig. 11 Obukpa aggregate slag mounds

and in later periods, perhaps maize cob roulette. Roulette decorated potsherds in Africa suggest Later Iron Age contexts (LIA) for Lejja. [4] argued that roulette traditions in Lejja date between 15 and 16th Century AD on the basis of pottery found from the excavations conducted in Amaovoko in 2010. According to their excavations, the criss-cross potsherds have similarities with the Akira tradition of East Africa with a date of approximately 160 BC onwards, but such a link seems tenuous at best. At the village of Obukpa, we observed few pieces of potsherds with criss-cross decorative motifs and one in situ potsherd with a deep grooved motif, which suggests a deeper antiquity.

Overall, the above account with regard to the site types and distributions are quite sparse, and the available information about their chronological development lacks detail because of the few dates and few sites recovered in Lejja [5]. However, this brief overview shows that Lejja has a dense concentration of surface artefacts, notably remains of iron working, domestic, and ancestral sites. This indicates that Lejja has great archaeological potential for the future [6].

Opportunistic survey

During the survey, several local informants were questioned about the settlement history, and the information we gained from our interactions and interviews with them led to the opportunistic discovery of 7 sites. These sites are labelled OP 01–OP 07. The informants interviewed were the King of Lejja Mr. Ugwuoke Nwani, Dr. Christian Opata and Mr. and Mrs. Amudiegwu among others.

OP01 is the colonial house of the warrant chief which was built by the colonial authorities in 1920 for the warrant chief of Lejja and his colonial administration. We could not obtain more information from this site except

that it is also the first two storey building that was built in Lejja. This house was built with mud, wooden columns, and a corrugated iron roof. The surface finds at the site comprise a dense cluster of potsherds.

OP02 is located further to the north of the grave at the village of Umuezeoda and it is a shrine called *Obueganwali*. Some items for worship at the *Obueganwali* shrine are still visible on the landscape, and most of the pots on the surface were perforated (see Fig. 13). One of the informants observes that the pots were used for traditional medicine purposes and for dispelling clouds and rain by the chief priest.

OP03 is a shrine of a female deity called the Adada (see Fig. 14). Adada is a female water goddess worshipped by both males and females alike. However, only females take the title that is assigned to the deity. At the shrine were



Fig. 14 Adada Shrine at Nkwo Lejja (The community traditional market)



Fig. 13 Obueganwali shrine



Fig. 15 Slag blocks at Ootobo-Dunuoka village square

large pots with roulette decoration motifs, and metal staff was visible in the shrine.(Fig. 15).

OP04 covers the Otobo-Dunuoka village square, where there is evidence of large cylindrical slag blocks. The cylindrical slag blocks were carefully arranged in rows with the diameter of the individual blocks ranging from 31 to 36 cm (see Fig. 16). Some of the slag blocks were also used for erosion control in and around the Otobo-Dunuoka site. The village square represents a ceremonial place where all the political decisions in Lejja are made. It is also seen as an epitome of traditional parliamentary and democratic consensus in Lejja [7]. Additionally, Dunuoka village, which harbours the slag blocks, is the only village that produces the ‘Eze’ (king) of Lejja. There are more than 800 blocks of slag, and the ends of some of them are either conical or spherical in shape [8]. The blocks look alike, but are of different sizes and the diameter of the slag blocks range between 31 and 56 cm [2]. The individual heights of the slag blocks ranged from 22 to 36 cm and the blocks weighed between 34 and 57 kg. The slag blocks at the village square are still intact because they are durable, and because of the traditional taboos associated with tampering with, or removing them from the village square [8] (Fig. 17).



Fig. 17 Roulette

OP05 is an iron smelting site situated near the Nkwo Lejja market. This iron smelting site is located at the foot of two adjacent hills. Most of the slag blocks are still in situ in their pits, while a few of them are broken, and imprints of grasses and wood can be seen on the slag. The two hills could be a source of iron ore, as haematite, gravel and boulders occur across their surface [9]. Trees such as oil bean trees suitable for the production of charcoal, which serves as smelting fuel, are seen along



Fig. 16 A selection of different ceramics at the Adada shrine at Obere

the footpaths leading to the site. OP06, in the southern part of Obukpa village square is a large tree, called the Egbu tree (*Nauclea latifolia*); at the foot of the tree is debris of slag blocks and pots. This tree is symbolic in Lejja because it was used as a medium of communication to summon the villagers for a meeting by kicking the hollow part of the tree with the left leg of the announcer during emergencies such as war. OP07 is another shrine located in the village of Umuogbueji that is also dedicated to the female deity called Adada (mentioned above). This spot below is called Obere. Many in situ pots with different decorative motifs were identified. Some of the pots are aligned in a straight line spanning 9.8 m (see Fig. 16). However, the purpose of the alignment is unclear. Some of the villagers believed that pots were used to demarcate the land (Fig. 18).

Approximately 70% of the pots are of roulette decorative motifs, although in one instance, a pot with perforation over the entire body was recorded on the site (see Fig. 16). This design is quite unique, and the pots are used for washing legumes, smoking fish, meat and processing breadfruits and locust bean seeds. The heat from the hearth could penetrate the perforations. Overall, the opportunistic sites further extended the range of site types in Lejja and increased the richness of our understanding of the archaeological potential of the region. One important conclusion that arises from the opportunistic survey is that given the large numbers of potsherds found at recent shrine sites, it is possible that some of the scatters identified in the transect survey represent former shrine sites. This possibility will be considered and tested in future research.

Discussions

The results of the transect surveys suggest that the Lejja area was densely inhabited over a long period, with different types of sites (iron smelting, domestic and ancestral),



Fig. 18 Criss-cross hatching

structures, and different material cultures. Iron smelting sites recorded during the survey were defined by the presence of iron smelting by products such as slag, furnace walls, haematite and tuyere fragments, which are quite abundant in Lejja. Although iron smelting waste products are found in the five states of southeastern Nigeria, the most abundant deposits of iron ore are located in the northern Igbo Plateau, Udi-Cuesta [2]. Iron ore exists in the form of oxides, haematite, siderite, goethite and magnetite. These are abundant in the region especially haematite. The fuel, mostly timber wood and/or charcoal, were also readily available, especially during the early and middle phases of bloomery iron smelting. Labour was also not scarce, especially in the period before the transatlantic slave trade [10].

As described above, six sites were designated as iron working sites, and these sites were particularly concentrated in the villages of Obukpa and Amaovoko according to transect surveys G01- G02 and A01-A03, respectively. The current project also chose to resample some of the previous sites, such as Dunuoka and Amaovoko due to the scale of the surface materials, the debate surrounding the controversial C-14 dates of 4005 ± 40 BP and 3445 ± 40 BP retrieved by previous researchers, which have somewhat contested, and the presence of previous excavations for comparison [5]. Although, these early dates for smelting in Lejja cannot be ruled out, other dates; namely; the 2050 ± 40 BP and $1715 \text{ BP} \pm 35$ BP dates seem more consistent with dates from the 'early phase' that cluster around or just over 2000 BP [5]. Dates retrieved under this project similarly cluster at 2000 BP [6]. Importantly, the dating from this site and for the early smelting phase in the wider region, as well as the dates obtained from the present project, clearly indicates that iron smelting has been occurring in Lejja for more than 2000 years and potentially longer. It is not clear whether these phases of smelting developed into a more varied longer-term sequence across the region.

Other key iron working sites are I01-I02 and OP 05. These sites are particularly characterized by large slag mounds; cylindrical slag blocks and aggregate slag, providing particular evidence for Early Iron working phase in southeastern Nigeria. The vast distribution, abundance and diversity of slag, iron ore, and tuyere on the landscape at Lejja show that iron smelting was performed on a very large and industrial scale over a long period of time. It also shows continuity and changes to attain the efficiency of smelting with little labour requirements due to severe threats from both the Atlantic and internal slave trades, internal wars and British colonization.

Previous work in the wider region identified early, middle and late phases of iron working, and noted a change in the technology from slag tapping to non slag tapping

furnaces and more efficient processes [2]. The characterization of the three phases was based on the analysis of iron working residues. The earliest/oldest iron smelting phase in southeastern Nigeria (2305 ± 90 – 2000 ± 90 BP), as proposed by [2] used a forced draught shaft furnace, and the slag when solidified had a cylindrical block shape. The furnaces measured 0.85 m to 1.25 m in diameter, and the thickness of the wall was 40 mm. Slag from these furnaces were tapped intermittently into slag pits using tuyeres as channels/funnels. SEM–EDS of the slag from the early phase revealed mainly fayalitic, hercynite and wustite compositions. In the middle phase (1060 ± 60 BP– 570 ± 60 BP), iron was smelted in the forced draught shaft furnaces. Slag were still tapped but not into pits but were allowed to flow out of the connecting tuyere and spread on the ground, thereby forming a flat smooth ropy surface forms. These iron slag survive as a flat cake forms [2]. The slag of the middle phase contains no free wustite, which suggests improved efficiency and mastery over the reduced iron extraction technique. A self induced shaft furnace was used during the late phase.

During the late phase (300 ± 90 BP– 130 ± 80 BP), the furnaces were not tapped during smelting but were removed after smelting, and the blooms were sorted from the residues. Iron slag at this phase survives at smelting sites in aggregate forms [2]. As a result of their extraction from the furnace by raking and sorting from the bloom, they survive as amorphous irregular aggregates [2]. SEM–EDS analyses of slag from the late-phase consist of fayalite, hercynite and glass. Free iron oxide is totally absent from the late phase. This demonstrates the high level of iron extraction efficiency attained by the late phase iron smelters [2]. Based on the above typology and from the past research that has been conducted in this region, the sites of Amaovoko and Dunuoka seem to have fallen into the early Iron working phase or early Iron Age phase. Previous excavation at Amaovoko has produced a date of 2155 to 625 BP by [4] and 2100 BP by [6] respectively. The aggregate slag is classified by [2] as falling into the middle/late phase of iron smelting, which is characterized by amorphous aggregate slag. Similar types of aggregate slag were also found during the survey in Amaebo-Attamah and Obukpa.

Our survey data clearly shows that in the past, Lejja was characterized by many distinct iron production sites that appear to be demarcated from sites with evidence of domestic features. These iron smelting sites are good indicators of Lejja site formation, size and organization given the variation in the technology employed. They reflect the state of the society during each phase. For instance, the early phase of old Nsukka iron smelting appears to have been peaceful, and therefore, the industry could afford to be very elaborate and complex

[2]. The smelters had enough labor and time to build and use forced draught shaft furnaces, dig slag pits, line them with clay and then provide connecting pipes/channels to the pits. The late phase appears to be faced with labour scarcity due to insecurity. As a result, the forced draught shaft furnace technique was abandoned in favour of the shaft draught furnace technique, thus eliminating the roles of bellowers [2].

Domestic sites with limited iron working remains and extensive pottery scatters are also well represented in Lejja, and many of these sites are in or near contemporary living areas. Some nine domestic sites were recorded, and these were especially concentrated in the Amaebo-Attamah, Umuodaeze, Ugwu-Amaovoko, and Eduga areas on transects B, C, D, E, F and H. Site sizes are variable, with some sites on Transect B measuring close to 300 m in diameter, while other such as transects D and E, range from 80–200 m. The most common surface artefacts encountered were pottery, but we also located a pounding mortar, dry-stone walls, terracing, forts, a manila fragment and cowries. The different ceramic types found at these sites suggest at least two distinct types, and perhaps different periods of sites did exist. The first is characterized by roulette decoration, while the second is characterized by criss-cross hatching and deeply grooved sherds. Based on findings reported elsewhere [4] and from the pottery recovered from this research we might very tentatively suggest that these two types of site are chronologically distinct, with the roulette types being more recent and the criss cross hatching and bands of deeply grooved potsherds being older. However, it is still difficult to date these two traditions completely.

As reported from findings in the excavations published elsewhere, criss-cross hatched ceramics may be associated with earlier phases of occupation in the early first millennium AD, while the roulette ceramics likely date to the second half of the first millennium or second millennium AD. Tentative dating of the roulette ceramics would place them in the period 1300 and 1650 AD. Most notably, 70% of the domestic sites have roulette decorated potsherds which occur both in dense clusters and in isolated form. A cursory examination of the vessel forms suggested that most of the pots encountered during the survey had everted rims. These roulette ceramics appear to be of a type also found in previous excavations at Amaovoko Lejja [4–6] and other sites in southeastern Nigeria, such as the Afikpo site, [11] and the University Farm site [12, 13].

There are also several domestic sites that display structural remains of habitation. These were concentrated on transect E, which sampled several hilltops and suggested a distinct form of hilltop habitation, sometimes with defensive features. Of interest were transects E03

and E04, which consisted of abandoned houses and were located on grassy hilltops. Transects E03 and E04 contain some potsherds and other contemporary household items, while E08 is a defensive fort with evidence of earthworks that is located on the hilltop and contains some ceramics or potsherds as surface materials. The sites with remains of houses and defensive features were dominated by roulette decorated potsherds but two different potsherds with bands of grooved lines were also located at the Ugwu-Amaovoko fort (Transect E08) and Eduga pottery sites (Transect H). The surface roulette ceramics seem to confirm that these sites were either Early or Late Iron Age sites. Currently, in the absence of further details, it is difficult to determine the wider settlement history. Finds of hillside terracing provide hints of this wider landscape history and suggest that more intensive survey and landscape mapping might be fruitfully employed in the region.

The ancestral sites consisted of shrines, graves, historic trees, and sacred sites. Most of the ancestral sites have symbolic and cultural connotations. In some cases, women are not allowed to be close to these ancestral features [7]. However, two of the shrines are dedicated to a female goddess called *Adada* meaning a great daughter in the local dialect. At some of these ancestral sites, evidence of potsherds, slag and iron ores is available. Most of these sites are currently in use. Unfortunately, we cannot place these sites in their proper chronological framework, but these are very important sites that provide good evidence of a rich ritual and symbolic landscape heritage that may have some antiquity.

Conclusion

As noted above, we currently lack detailed information from either radiometric dates or a detailed ceramic or artefact typology to place the sites located during this survey into a chronological sequence. However, we can tentatively argue that sites with criss-cross hatching potsherds tend to be older than sites with roulette pottery, and that limited dating from the excavated domestic sites and iron smelting sites suggests that criss cross hatching pottery may have fallen in the early first millennium AD and perhaps earlier, while roulette decorated potsherds fall into the second millennium AD [4]. We can also infer a tentative chronology for smelting sites based on these dates with regard to the early and late iron smelting sites, as explained earlier. The survey conducted in Lejja is a preliminary study and lacks a broader framework. However, we hope that the number of sites identified by this project will serve as a clear demonstration of the archaeology of Lejja as well as a guide for future research.

The survey in the different villages, points to a rich archaeological record from the Iron Age onwards.

Evidence of agricultural practices was also observed across the sites, including terrace platforms and more recent farmsteads. The material culture of the region is dominated by roulette decorated and impressed potsherds with several of the roulette types identified, including fibre knotted, maize cob and possibly net impressed. The presence of maize cob roulette might have implication for the chronology of the site where they were found. However, more research is needed before a tentative conclusion can be made. The few rims recovered from some sites during the survey were everted with some bands of decoration on the neck. This ceramic allows for a very tentative chronology as outlined above, which suggests some differentiation in sites through time. No imported ceramics were recovered from any of these sites. Similarly, changes to iron smelting finds tentatively support the presence of a chronology of metal working techniques.

It is further clear from the survey that there seem to be distinct areas on the landscape for habitation and metal working, although it is yet unclear what this distinction represents in terms of social organization, particularly whether they represent one community with different activity sites or two communities with distinct identities or indeed a more complex temporal and spatial pattern. The finding from the surface surveys also allow for comparisons with excavated materials and for a discussion of likely discoveries of future sub-surface remains and buried features. Additionally, domestic sites with limited iron working remains and extensive pottery scatters are well represented in Lejja, and many of these sites are in or near contemporary living areas [14–16].

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Author contributions

Authors 1, 2, 3 and 4 wrote the main manuscript, prepared the figures and reviewed the manuscript.

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Availability of data and materials

All of the material is owned by the authors and/or no permission is required. All data are provided in this article.

Declarations

Competing interests

The authors declare no competing interests.

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